

Lombard Coke Ovens Complex
On the North Bank of the Missouri River,
Upstream from the Toston Dam Reservoir
Toston Vicinity
Broadwater County
Montana

HAER No. MT-54

HAER
MONT,
4-TOS.V,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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HISTORIC AMERICAN ENGINEERING RECORD

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I. INTRODUCTION

Location: On the north bank of the Missouri River, upstream from the Toston Dam Reservoir, Toston vicinity, Broadwater County, Montana

Quad: USGS 15' series, Toston, Montana
UTM: Zone 12, 467500m Easting, 5106050m Northing

Constructed: 1907, operational 1909, idle 1910-1915, abandoned 1916

Builder: Western Coal and Coke Company, Lombard, Montana

Significance: The Lombard coke oven site represents a specific stage of technological development in the coking coal industry. The relationship of the structures and features at the site reflect the technology and methods used at an early 20th century coking establishment. Due to the short period of operation, the existing ovens were not exposed to the repeated heating and cooling to which most coke ovens were subjected, and today are in fine condition.

Site Description: A battery of twelve coke ovens are surrounded by a rectangular stone structure, three coal slack piles, a collapsed adit and tipple, a caretaker's cabin, and several stone foundations and walls. Scattered debris includes red bricks, sheet metal and strips of metal, track ties, rotted sawn and planed timbers, broken glass, stone, wood and metal wheels, gears probably used in the tipple, a fresno blade, and refuse piles. The site measures 175 feet (53m) by 1125 feet (343m) or 196,875 square feet (18,175m²).

Historian: Ted Catton, Historical Research Associates,
March 1988.

II. COKE OVENS DESIGN

The coke oven structure consists of a battery of twelve ovens, built in a row for economy of construction, enclosed on three sides by stone masonry and on the fourth side by banked earth. The complex is built into a gently sloping hillside, with the prominent downslope wall displaying twelve arched doorways into the ovens.

Each of the twelve coke ovens is 13 feet in diameter at the base, 7 feet high, and beehive-shaped on the inside. The interior walls are built with Pennsylvania red clay firebricks. The oven is accessed both through an arched doorway in the front and a port ring in the crown. The doorway measures 32 inches wide by 38 inches high. The arch above the doorway consists of wedge-shaped granite blocks, about nine inches high, topped by a supplemental sustaining arch of bricks. The sides and foot of the doorway are lined with metal jambs and a metal sill. The jambs have notches into which hooks on a door could be fitted. The port ring

in the domed ceiling consists of a granite wheel, two feet in diameter, with a 13-inch hole in its center for venting smoke.

The walls which enclose the battery of ovens on three sides are built of locally cut granite blocks placed in a random ashlar pattern. The structure is about 175 feet (65m) long, 20 feet (6m) wide, and 8 feet (2.5m) high. The structure is filled with earth to the rim of the wall so that all but the top of the dome of each oven is covered. On the open, or uphill, side of the structure, the earthfill slopes down forming a ramp or loading chute for each oven. Stone retaining walls separate the twelve loading chutes, and apparently line up with the subsurface walls partitioning the twelve ovens.

The specifications for the Lombard coke ovens incorporate many of the design features of the "modern coke oven" as prescribed by John Fulton in Coke: A Treatise on the Manufacture of Coke and other Prepared Fuels (1905). The Lombard coke ovens exhibit, for example, the double arch above the doorway which Fulton recommends, the purpose of the higher arch being to sustain the front of the oven structure while repairs are being made to the large shaped blocks of the lower arch. The oven's dimensions approximate those of the Wharton model coke oven, which Fulton gives as 12 feet in diameter, seven and a half feet high, with a

doorway measuring 33 by 42 inches. The metal jambs and sill in the doorway conform to Fulton's advice that the arch piece over the metal door frame should be omitted (due to its expansion under heat). The brick interior surfaces of the oven domes are smooth, in keeping with Fulton's recommendation that "they should be shaped to conform to the radial planes of this portion of the oven to secure compactness and stability, and the whole should be keyed firmly by the charging port ring in the crown of the oven" (Fulton, 1905).

In other respects, the Lombard coke ovens reflect a low capital investment and somewhat simplified design. Typically at the turn of the century, coke ovens were built in batteries of 100 ovens or more, often in two rows back to back. These larger plants were built on "wharves", or elevated foundations, with railroad tracks running down one or both sides. The coke could then be trundled across the "yard" and dumped off the edge of the wharf into ore cars. The common design for these large batteries also called for a "larry track" (a track for ore cars) running along the top between the two rows of ovens so that unprocessed coal could be charged directly into the port rings from ore cars, or "larries". A third common feature which appears to have been impractical for the small establishment at Lombard was the installation of a cast-iron water pipe two and a half

feet below the surface of the wharf, with a tap into each oven. Evidently loading the coal, watering, and unloading the coke was all performed by hand at Lombard.

There is both physical and documentary evidence that the builder of the coke ovens envisioned an eventual battery of one hundred ovens, with a wharf, larry track, and spur off the nearby Northern Pacific Railroad. The physical evidence consists of a rock retaining wall which parallels the coke oven structure on the downslope side, about 25 feet (7m) away. The "yard" which this structure defined is still readily visible although it has been eroded. There are some rotted track ties embedded in the floor of a ditch paralleling the wharf. Documentation of the proposed layout consists solely of a contemporary newspaper account. The short-lived Crow Creek Journal of Toston, Montana, in a November 3, 1907 article, described the promise of the new establishment under the dubious headline "Mountain of Coal Unearthed." It claimed that foundations were completed for fifteen ovens, with six of the ovens finished, and construction of another 85 ovens projected in the spring. A 25-foot wharf was being built in front of the ovens, and a bed for a railroad spur was being excavated. The plans called for an engine house 116 feet uphill from the ovens, with a weigh room, crusher, washroom, and launder staggered down the slope, and finally a "6 ton larry which carries

[the coal] along the line of ovens, 6 tons being an oven charge" (Crow Creek Journal, November 3, 1907). Apparently these plans progressed no further than completion of the twelve coke ovens, the wharf, and the railroad spur, at any rate there are no larry track T rails amongst the debris at the site.

III. INDUSTRIAL PROCESS

At the turn of the century, bituminous coal was converted into coke by removing its impurities through a process of "dry" or "destructive" distillation. The coal decomposed under heat, emitting gases which could be burned slowly with the introduction of air through vents in the oven door. The heavy black smoke escaped through the hole in the ceiling while the domed brickwork reflected and radiated the heat back on the coal. The process took 48 to 72 hours, depending on what the coke was to be used for. The most important use of coke was in the metallurgical industry as a fuel and/or reducing agent in furnaces or foundries. Furnace coke was produced in 48 hours, while foundry coke required a 72-hour coking period.

The Lombard coke ovens were located within a hundred yards of the K. O. Hegg coal mine. The coal was charged into the ovens through the openings in the tops, and levelled off with a rake, allowing a small air space. The

metal doors were then closed and bricked up, and probably daubed with loam, leaving some interstices for a bottom draft. After 48 hours, water was poured into the ovens, which arrested the coking process and gave the coke a silver-gray luster. The finished coke consisted of a solid mass, which had to be broken in order to extract it through the front doorway (U.S. Bureau of the Census, 1907).

The beehive coke ovens at Lombard represent an intermediate stage of technology between coking in mounds and by-product ovens (U.S. Bureau of Mines, 1913). By-product ovens, introduced in the 1890s, extracted a variety of valuable by-products from the coking process, including coal tar, ammonium sulphate, and ammonia liquor, which were simply burned off in beehive ovens. In 1907, the year of construction of the Lombard coke ovens, the great majority of coke manufactured in the United States still came from beehive ovens, because they required a much smaller capital investment (U.S. Bureau of the Census, 1907). Yet the years 1909-1917 saw the manufacture of beehive coke fluctuate and decline as it increasingly took an auxiliary role to the steady, capital intensive production of coke in by-product ovens (U.S. Geological Survey, 1921).

IV. HISTORY

In 1899 two prospectors, John Sagerhamer and Hildo

Johnson, discovered an outcrop of coal on the hillside above the railroad about one mile from Lombard. They dug and timbered a tunnel about 150 feet into the slope and found a large body of coal. The two men filed a claim for the property at the Broadwater County Courthouse on March 30, 1899. As was often the case on the mining frontier, the prospectors could not afford to develop their claim and awaited capital investors. In the meantime they performed the necessary improvements to maintain their claim (Crow Creek Journal, November 3, 1907).

John Gorman, an electrical engineer from St. Paul, Minnesota, visited the claim in 1902 and took samples of the coal back with him. With two other Minnesotans, Samuel Stearns Crooks and Charles S. Sharwood, Gorman proposed a stock company of five partners, offering to pay Johnson and Sagerhamer \$500 and give them each 100,000 shares. The prospectors apparently rejected this offer and finally chose to sell a half interest to W. B. Dolenty and Company, Bankers, of Townsend, Montana instead, and the coal mine remained undeveloped.

In August 1906, the mine was purchased by another partnership of Minnesotans. Karl O. Hegg, a Minneapolis broker, together with Franz Pearson and Andrew Hanson, acquired patent to Coal Entry No. 123 and a 298-acre tract to the east; north and west of the coal strike, paying

\$5,961.20, or \$20.00 per acre (Bureau of Land Management tract book, no date). This marked a considerable investment. The Montana Inspector of Coal Mines noted that the "Minnesota capitalists are developing on rather a large scale in the neighborhood of Lombard and have opened a seam over seven feet in thickness." The coal was of a good variety and suitable for coking (Inspector of Coal Mines, 1906). The partnership formed the Western Coal and Coke Company (U.S. Geological Survey, 1907.)

All evidence points to a flurry of development at the Hegg Mine throughout 1907, after which it became virtually inactive. In the spring the Western Coal and Coke Company hired Thomas N. Dall, an experienced civil and mining engineer and a graduate of Oxford University, as manager. Dall drafted plans for all the mine and camp buildings, and coke ovens. Dall supervised a crew of men in constructing a bunkhouse, boarding house, barn, and engine house over the mine adit (Crow Creek Journal, November 3, 1907). By August 1907 the company was operating a steam hoist and was employing fifteen men in the mine under the supervision of a Townsend, Montana engineer named George S. Norton, Jr. In the meantime, the manager had "recently purchased a large tract of timber from the Forest Reserve" for mine timbers, and had contracted for "one of the largest washers in the country" (Crow Creek Journal, August 8, 1907). A locally

prominent geologist, Professor J. P. Rowe of the University of Montana, inspected the mine in 1907. By November, the company had developed 2,000 feet of tunnels, which followed a coal seam from 5 to 7 feet thick that dipped down on about an 18 degree slope. Work commenced on the coke ovens in the fall (Crow Creek Journal, November 3, 1907).

The owners of the Western Coal and Coke Company envisioned installing a plant of 100 beehive coke ovens. This would have been an appreciable investment, amounting to at least over \$30,000, for the cost of one Wharton coke oven in 1905 (of similar design to the twelve ovens designed by Dall in the summer of 1907) was estimated to be \$311.70 (Fulton, 1905). While the quality of coal from the Hegg Mine varied, and its quantity was of course uncertain, the location of their mine had the dual advantages of ready access to the Northern Pacific Railroad and a dependable water supply from the nearby Missouri River.

Dall's plans for the coke ovens took advantage of the topography. Built on a hillside about 200 feet from the railroad, the coke ovens would form a single row, facing downslope, with one yard and wharf connecting to a railroad spur. The slope of the hill would enable the operators to convey the coal easily from the mine to the ovens -- by way of the weigh house, the crusher, the washroom, the launder, and finally the larry track -- all of which would form a

procession down the hill from the hoisting works (Crow Creek Journal, November 3, 1907).

The washer was a progressive feature in Dall's design. Washing the coal before coking helped separate the slate, pyrite and other impurities, and was found to produce higher quality coke. Yet in 1907, 88% of mine-run coal used for coking in the United States was charged into the ovens without being washed. (U.S. Geological Survey, 1908). The water used in the washer, as well as in the camp buildings, would be pumped from the Missouri River (Crow Creek Journal, November 3, 1907). Both the crusher and the washer were incorporated into the overall plan to get the best results from coking; however, it is unclear whether this machinery was in place in the short time that the twelve completed ovens were operational.

In November 1907 the Crow Creek Journal reported that 35 men were employed at the mine, and some masons from Minnesota were working on the ovens. Apparently reporting the views of company officials, the newspaper announced that with 85 more coke ovens to be built in the spring, they were anticipating "a coal camp of about 700 people." It observed further that the masons were building the ovens to last not two or five but fifteen years. The coke would probably be consumed by the nearby cement works and smelters (Crow Creek Journal, November 3, 1907).

One month later the optimistic editor of the Crow Creek Journal ran a story with the headline "Lombard Coal Mines Will Not Shut Down." The company did not intend to lay off workers during the winter. The editor allowed that this news might surprise some readers, but he had the information from reliable sources (Crow Creek Journal, December 12, 1907).

The Minnesota capitalists may have been changing their minds about the Hegg Mine, a conclusion supported by the absence of any mention of the mine or the coke ovens in the Montana Inspector of Coal Mines' reports after 1906. Whereas the Biennial Report for 1905-6 records "rather a large scale" development near Lombard, the subsequent reports for 1907-08, 1909-10 and 1911-12 make no reference to coal production in Broadwater County. The annual U.S. Geological Survey's Mineral Resources of the United States for the years 1907-1916 also suggest that the Hegg Mine and coke ovens were short-lived. In 1907 the U.S. Geological Survey recorded twelve new coke ovens built in Montana. These were idle in 1908, though in 1909 it reported that two plants in Montana were operated: the Western Coal and Coke Company at Lombard, and the Montana Coal and Coke Company at Electric. Only the latter operated in 1910, and in 1911-1915 all plants in the state were idle. In 1916, the U.S. Geological Survey noted, the last two coke plants in

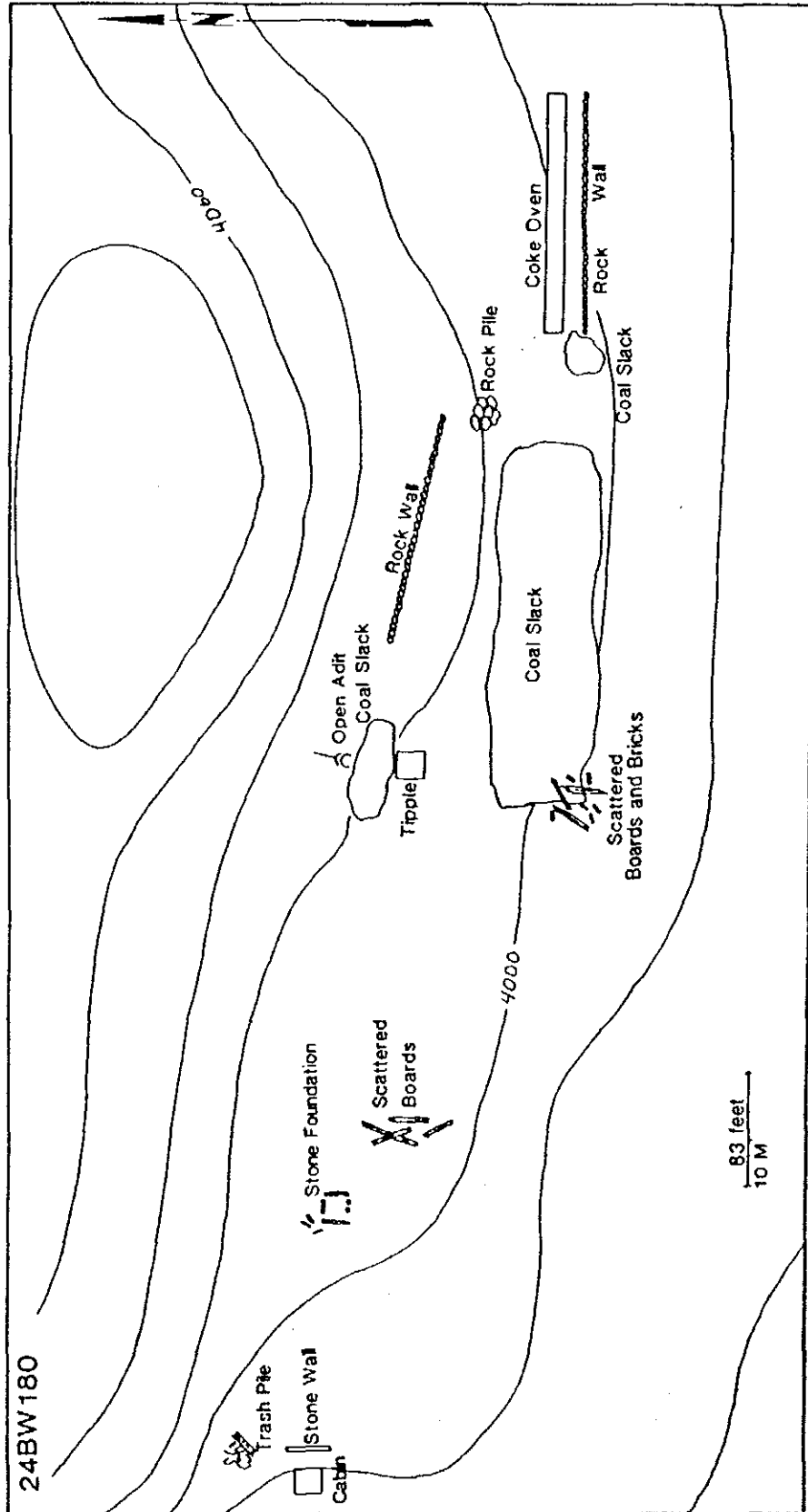
Montana, including the twelve-oven establishment near Lombard, were abandoned. The geologist, Professor J. P. Rowe, wrote in 1933 that the Lombard coke ovens were "worked for a short time" (Rowe, 1933). Today the ovens are partially filled with ash, charred wood, and coke slag and the ceiling bricks are only somewhat blackened. Probably the coke ovens were operated only in the year 1909, possibly just for a few charges.

In relation to the coking industry in Montana, and the nation as a whole, the contributions of the K. O. Hegg Mine and coke oven establishment appear to have been negligible. The nation's coking industry was concentrated around the anthracite coal fields in Pennsylvania. Montana's bituminous coal fields barely attained the quality needed for manufacturing coke, in fact some coal for coking was brought into the state from the East (U.S. Geological Survey, 1921). Montana was further handicapped by the trend in the coking industry, encouraged by the growth of railroads, to locate coke oven establishments near the points of consumption (the steel foundries and smelters) rather than near the coal beds. These factors precipitated a relative decline in Montana's coke industry which lowered its rank among coke producing states from tenth in 1900 to 20th in 1905 (U.S. Bureau of the Census, 1907).

The Lombard coke ovens were the last of five coking

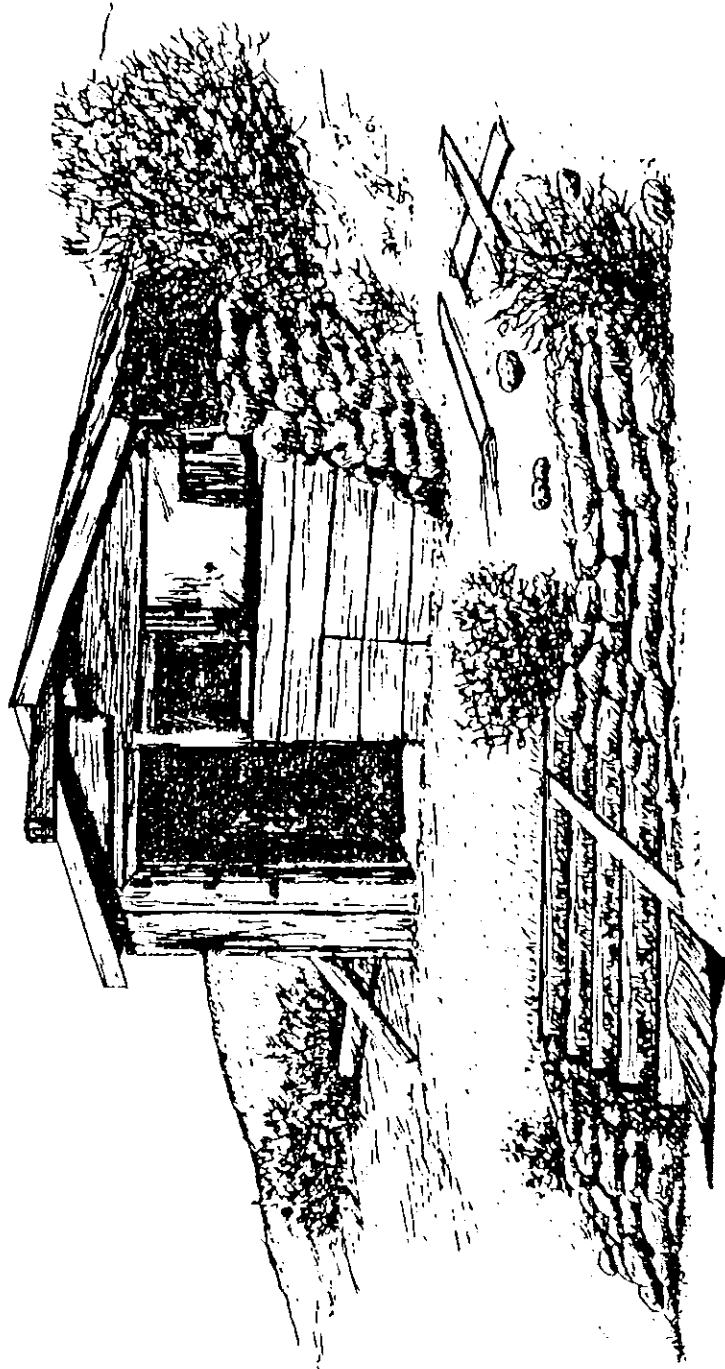
establishments built in Montana, indeed they were built in the waning years of the industry in Montana. All five establishments comprised beehive ovens. There was a battery of 100 ovens at Belt, 220 at Electric, 100 at Cokedale, 100 at Storrs with a second battery of 100 partially completed, and the unfinished establishment near Lombard (Rowe, 1933). By 1910 all of these establishments had ceased production.

Whereas the K. O. Hegg Mine and coke ovens appear to have been a speculative venture which was soon abandoned when the coal strike did not meet the expectations of the investors, the abandonment of the other four coking establishments in Montana resulted from more long range factors. Increasingly, smelting companies in Montana could buy coke shipped by rail from Utah or Colorado for less than the cost of coke produced from low-grade bituminous coal in Montana. Montana's beehive oven establishments were disadvantaged also by the rising value of by-products secured from coking in the more capital-intensive by-product ovens. (In particular, road construction and munitions factories were large consumers of these by-products.) The tremendous growth of heavy industry in the United States during World War One, poured capital into the nation's coking industry, finally rendering the technologically backward beehive oven establishments in Montana uncompetitive.

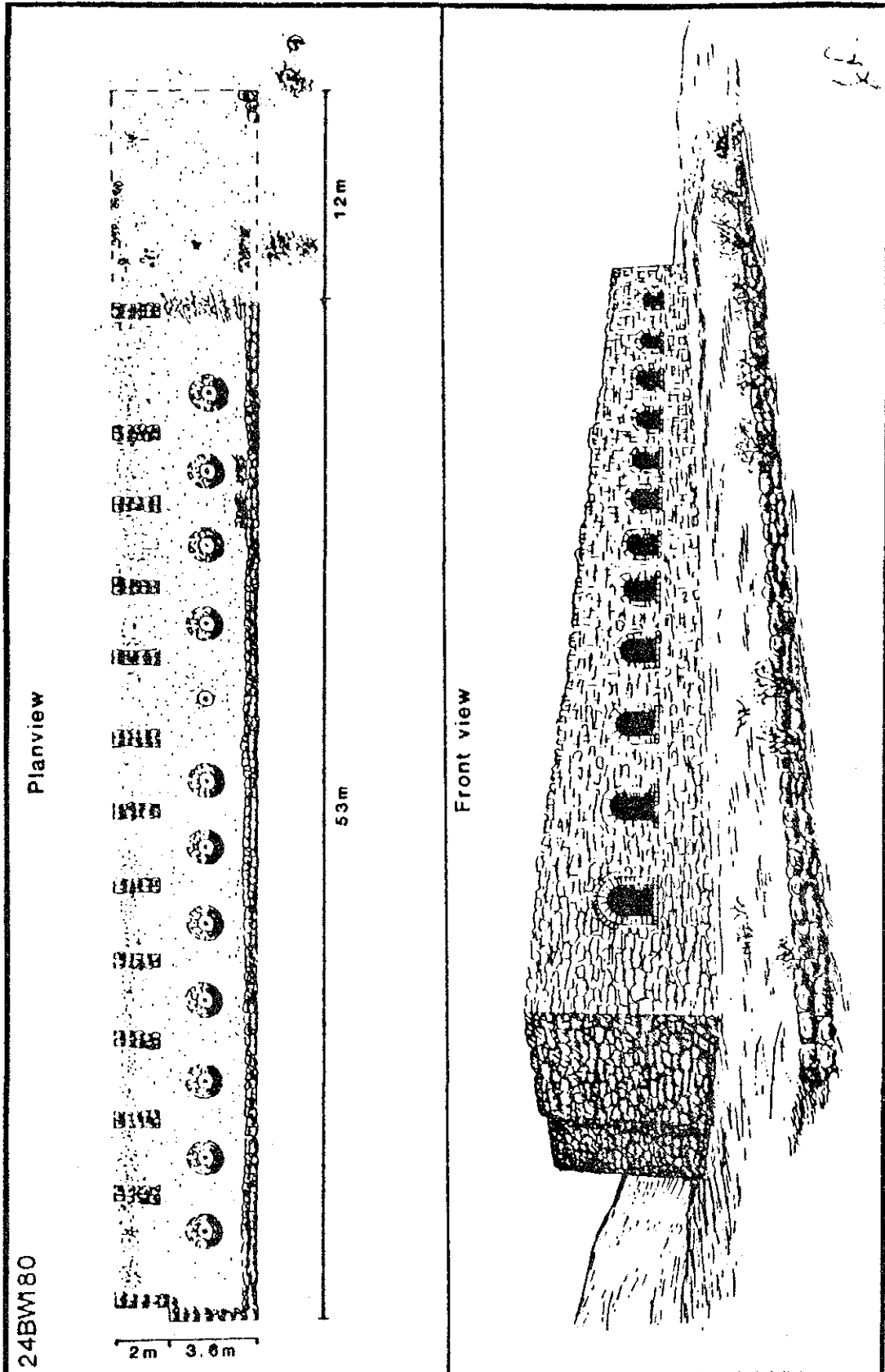


Plan map of site showing the distribution of features and structures across the site area. Sketch by Jim Duran. (Herbort 1986:31).

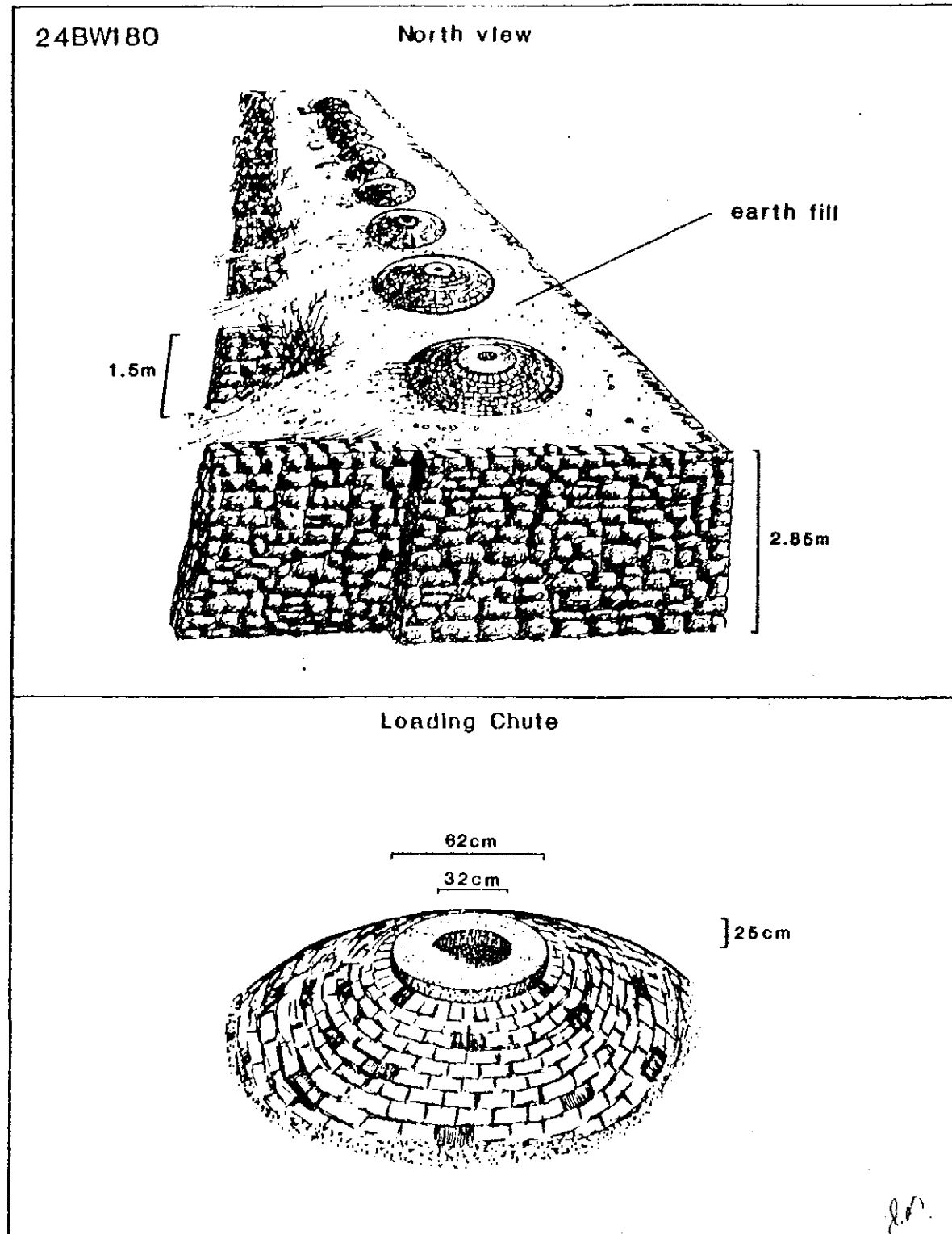
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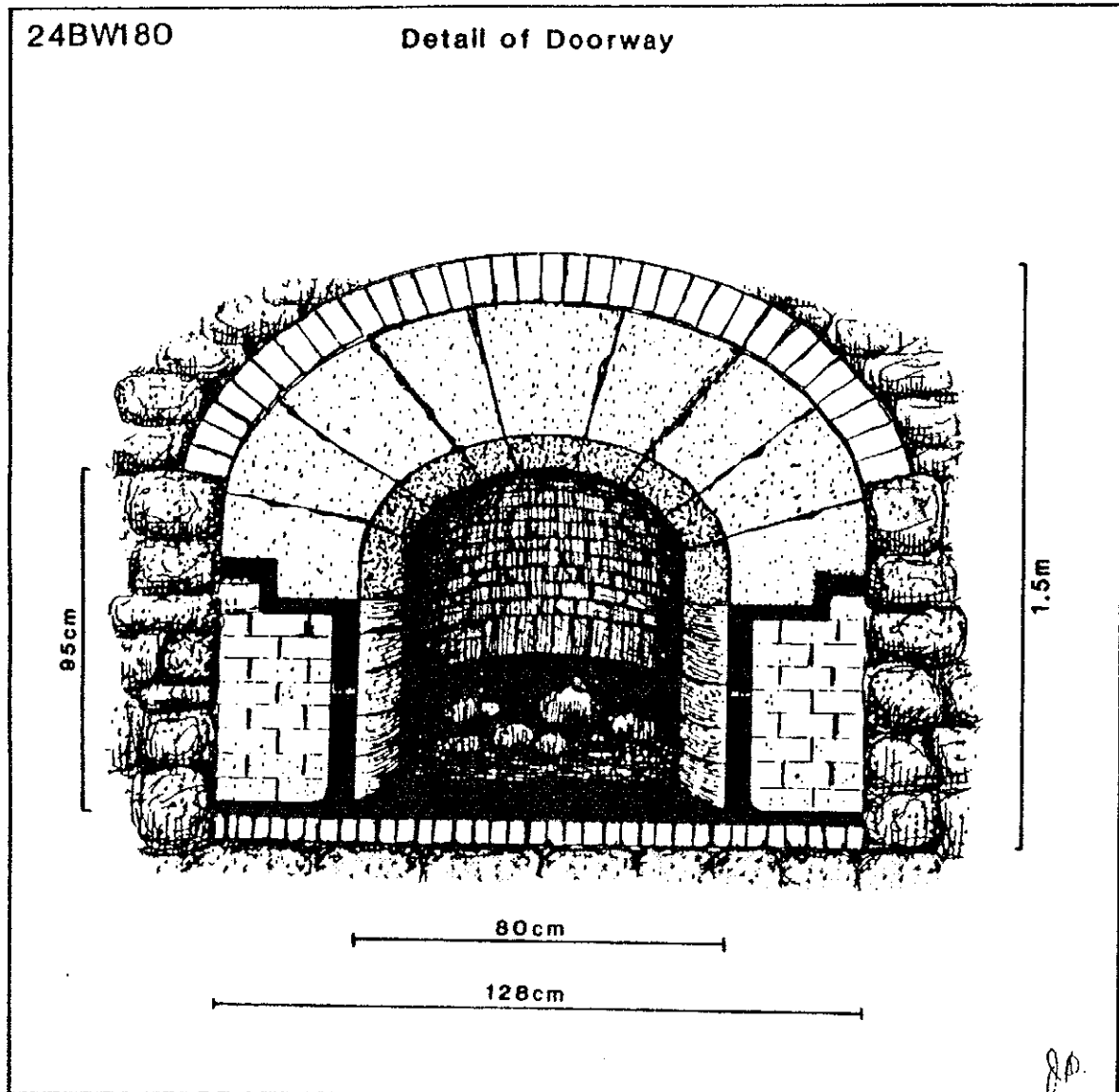
Artist's sketch of the Caretaker's house at the Lombard Coke Oven site.
Sketch by Jim Duran. (Herbort 1986:32)



Artist's sketch of the coke ovens showing the ovens in planview and front view.
Sketch by Jim Duran. (Herbort 1986:33)



Artist's sketch of the coke ovens showing detail of the structure and of the loading chutes. Sketch by Jim Duran. (Herbort 1986:34).



Artist's sketch showing detail of the doorways on the coke ovens. Sketch by Jim Duran. (Herbort 1986:35).

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